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LORD OF THE FLIES:

AN ETHOLOGICAL STUDY OF DOMINANCE ORDERING IN A GROUP OF HUMAN ADOLESCENTS

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Paper presented at the Biennial Meeting of the Society for Research in Child Development, Denver, Colorado, April 10-13, 1975.

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A stable, ordered dominance hierarchy was found via observational and sociometric methods for a group of 13-year-old boys during a five-week summer camp. This group structure was formed early in camp and was stable across settings, time, and types of dominance interactions. The hierarchy correlated significantly with the rank-orderings bed position and hiking position and highly, but not significantly, with athletic ability, physical fitness, chronological age, and late popularity. Group characteristics and individual differences are noted, especially in regard to the alpha and omega individuals. The dominance hierarchy appears to serve in the reduction of antagonistic behaviors and, on an individual level, to provide knowledge of where one's place is among one's peers.

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He hesitated for a moment, then spoke again.

"What's your name?"

"Ralph."

The fat boy waited to be asked his name in turn but this proffer of acquaintance was not made; the fair boy called Ralph smiled vaguely, stood up, and began to make his way once more toward the lagoon. The fat boy hung steadily at his shoulder. . .

The fat boy glanced over his shoulder, then leaned toward Ralph.

He whispered.

"They used to call me 'Piggy.'"

Ralph shrieked with laughter. He jumped up.

"Piggy! Piggy!"

"Ralph--please!"

Piggy clasped his hands in apprehension.

"I said I didn't want--"

"Piggy! Piggy!"

Ralph danced out into the hot air of the beach and then returned as a fighter-plane, with wings swept back, and machine-gunned Piggy.

"Sche--aa--ow!"

He dived in the sand at Piggy's feet and lay there laughing.

"Piggy!"

Piggy grinned reluctantly, pleased despite himself at even this much recognition. (William Golding, Lord of the Flies, pp. 6-7, 9)

INTRODUCTION

In the past, few human developmental psychologists have appeared willing to accept the phylogenetic relatedness of man with the remaining species members of the Primate Order. The ethological approach, however, assumes that even though social behavior is in many respects species-specific, commonalities do exist among species kin. Man may be unique (as are all species) and "highly" evolved, but he has had no special creation, having been subjected to the same evolutionary laws as all living organisms (Tiger, 1970).

Common to most primate species are social interactions that structure the social group into a system of status differentiation, necessary for group formation and maintenance and for contributing predictability of social behavior in the form of security and order (Rowell, 1966). Tinbergen (1968) argues that man still genetically harbors a number of behaviors that predispose him toward the formation of hierarchical status relations which strike a balance between aggression and fear and which allow for the regulation of social interaction. (Note the circularity: social interactions give rise to status differentiation which then regulates social interactions.)

From a human developmental psychological perspective, status differentiation serves an individual's need for recognition of his place among his peers, allowing him to find a place for himself within a network of interactions (Omark and Edelman, 1973). The present study focuses on early adolescence because it is during middle childhood and early adolescence that the peer group becomes most influential in the establishment of self-concept and identity (Hartup, 1970). Following the ethological approach, the study described below utilizes a multi-dimensional definition of dominance in a primate paradigm, but employs both behavioral and sociometric procedures. Based on an earlier pilot study conducted at the same setting one year previously (Williams, 1974), it was expected that a system of status relations would be established in an adolescent group and would be stable over time, structuring socially meaningful aspects of interpersonal behavior.

METHOD

Setting

The setting was a five-week boys camp in North Central United States. The camp's purpose is to develop character, citizenship, and leadership in young Americans. The camp has over 400 acres, bordered on three sides by water, with sand dunes and wooded areas. Facilities allow for a variety of recreational and interest activities, e.g., canoeing, crafts, discussions, intellectual contests, and sailing.

Subjects

One group of six 12- and 13-year-old boys (mean age, 13.0 years) was extensively studied over a five-week camping period. These six formed a homogeneous sample: being all Caucasian, Protestant, upper-middle class, and mentally-physically-emotionally healthy adolescents from intact families living in the suburbs.

The boys were randomly assigned to cabin groups by the camp administration on the basis of similarity of age and diversity of geography and athletic ability. Four of the six boys had previously been to this particular camp and thus knew each other upon arrival to camp; but they had never been placed in the same cabin group with each other, nor were any "old friends."

Procedures

1. Observational Data

The author as observer recorded from Day One through Day Thirty-Three (the beginning and closing of camp), by using the "all occurrences of some behaviors" event sampling technique (Altmann, 1974), all verbal and physical status interactions within the cabin group. Sampling was systematically dispersed throughout the daily schedule: during meals (three 20-minute periods), rising from and going to bed (15 minutes twice a day), rest hour (60 minutes), cabin discussions and meetings (30 minutes), and athletic activities (30 minutes) for a total of three and one-half hours per day.

Detailed recording of behavior by the author was possible, in part, because the boys assumed he was writing letters or engaged in normal counselor duties. When instantaneous recording was not possible (mealtimes), the behavioral interactions were recorded immediately afterwards. The effect that the observer as a group member may have had on the study's results is unknown, but every attempt was made to adopt a laissez-faire attitude during cabin status interactions. However, the detailed behavioral recordings, the enriched data examples, and even the existence of the study itself would not have been possible if such a dual role had not been assumed.

2. Sociometrics

Since direct observations can be supplemented and validated by utilizing the human proclivity for language, a questionnaire was given to each cabin member on Day Three and on Day Thirty-One asking him to: (1) "List the campers in the cabin, including yourself, in order of toughness or dominance" and (2) "List in order your friends in the group." The results were not known by the author until the camp session was over.

Mid-way through camp each boy completed a group characterization exercise in which he was instructed to write the name of the one cabin member, including himself, "Who is the _____ in the cabin." Forty adjectives or roles were inserted in the blank by the author, e.g., meanest, follower, most handsome, smiler.

On the author's day-off, once each during the second and fourth weeks of camp, two junior counselors assumed leadership over the cabin for one day apiece. They were each asked on the following day to rank the cabin group on the basis of toughness/dominance.

3. Cognitive and Physical Tests and Measurements

Given or measured in part or in totality were the Wechsler Intelligence Scale for Children, the Torrance Test of Creativity, Rotter's Internal-External Locus of Control Scale, the Harvard Step Test, Tanner's Five Stages of Pubertal Development, and the Dubois Body Surface Area Chart.

4. Indices of Status (Dominance)

Based on a prior pilot study (Williams, 1974), eight status indices were distinguished ("X" being accorded higher status or dominance over "Y" in each case):

(1) VERBAL COMMAND/ORDER: X tells Y what to do and Y complies. This may vary along a continuum from suggestion to direct command. Example: X tells Y, "Get up!" and Y does.

(2) VERBAL RIDICULE: X teases Y or calls him a name with Y "taking it," usually withdrawing from further interaction. Example: X calls Y a "dolt" and Y looks away or does not respond.

(3) PHYSICAL ASSERTIVENESS WITH CONTACT: X pushes, shoves, or hits Y in earnest or in fun. Y takes a submissive posture, flees, or if fights back, loses. Example: X hits Y with a boiled egg and Y runs.

(4) SUBMITS SELF: Y places X in a dominant position. Example: Y waits for X to tie his shoe along the trail.

(5) PHYSICAL OR OBJECT DISPLACEMENT: X takes an object away from Y, or X approaches Y and Y moves. Example: X moves toward his favorite chair in the dining hall and Y quickly moves away.

(6) VERBAL OR PHYSICAL THREAT: X boasts or asserts verbal and/or physical authority over Y. Example: X says to Y, "If you don't shut up I'm gonna come over and bust your teeth in."

(7) IGNORING OR REFUSAL TO COMPLY: X, commanded by Y, assertively or passively disobeys and Y does not pursue the demand. Or Y may submit an idea to X and X refuses to acknowledge. Example: Y tells X, "Pass the peanutbutter." and X ignores.

(8) VERBAL BATTLES: X argues with Y and gets the last word in. Example: Y says, "I was here first." and X replies, "tough shit!" Y does not respond.

Subjects ranked significantly the same regardless of the status index (W=.62, p .01, Kendall Coefficient of Concordance, Siegel, 1956). Thus, for purposes of this study, these eight indices were aggregated to form the behavioral definition of status (dominance).

RESULTS

Existence of A Dominance Hierarchy

1. Observational Record

Each boy was given a percentage score based on the proportion of times he was dominant in his dominance interactions with other cabin members (see Table One). The six boys can be arranged in a hierarchical order from most (Alpha: 83%) to least (Omega: 24%) times dominant. The percentage of times a particular boy was dominant over another is presented in a Matrix Completion format (Altmann, 1974) in Table One. By comparing the section above with the section below the diagonal line, one can graphically see the orderliness of the dominance hierarchy (13 of the 15 percentages above the line are over 50% after 31 days of camp). There does not appear, however, to be a systematic status differentiation among Delta, Epsilon, and Omega.

From the binomial probability distribution of dominance interactions among dyads, 12 of the possible 15 pairings of subjects are significant beyond the .0003 level (see Table Two). Once again, the exceptions are the last three boys in the hierarchy.

2. Sociometric Rankings

The group sociometric dominance rankings were derived by averaging the individual rank-orderings, including self-rankings, of the boys on Day Three and on Day Thirty-One (see Table Three). There was a significant intra-group agreement on relative rank at the beginning and closing of camp.

3. Comparison of Sources (Reliability)

The two different methods of determining the dominance hierarchy yield significantly the same rank-ordering at the beginning ($r=.90$, $p<.05$) and closing ($r=.94$, $p<.01$) of camp (Spearman Rank Correlation, Siegel, 1956).

The sociometric rankings of the junior counselors were significantly similar to the overall behavioral rank-order for both junior counselors ($r=.83$, $p<.05$; $r=.94$, $p<.01$) (Spearman Rank Correlation, Siegel, 1956).

Onset and Stability of the Dominance Hierarchy

On both the observational record and the sociometric rank-orderings a stable, ordered hierarchy appeared by the third day of camp (see Table Four). In all ten dyadic comparisons the X was dominant, as expected given an ordered dominance hierarchy, over a Y more often than the reverse. The percentage of transgressions against the dominance hierarchy after three days (23%) is only slightly higher than after 33 days (20%) of camp.

The stability of the behavioral dominance hierarchy increased during the course of the camp period: all percentages above the diagonal line when the last six days of camp are isolate are greater than 50% and the percentage of reversals of dominance interactions (8%) is extremely low (see Table Five). Several factors, however, suggest fluctuation in the rank-ordering during the observations: the equality of time the last three boys were dominant for the total time period; the non-significant binomial dyadic relations of the last three boys; and the meteoric rise in the percentage of times dominant for Delta from the first three days to the last six days (18% to 50%).

Stability across Settings

The subjects ranked significantly the same regardless of setting ($W=.71$, $p<.01$, Kendall Coefficient of Concordance, Siegel, 1956). The lowest percentage of intransitivities was during meals, 14%, and the largest during cabin discussions and rest hour, 23%.

The greatest per hour frequency of dominance interactions occurred during rising from and going to bed (12.0) and during rest hour (8.7). Mealtimes proved to be the most peaceful (5.9). "Verbal Command/Order" and "Verbal Ridicule" were common expressions in all settings. "Physical Assertiveness with Contact" and "Verbal Battles" were most common during rest hour, "Submits Self" during discussions, "Physical or Object Displacement" during meals, and "Verbal or Physical Threat" and "Ignoring or Refusal to Comply" during rising from and going to bed.

Correlations with the Dominance Hierarchy

A significant correlation was found between the dominance hierarchy and the following rank-orderings:

(1) BED POSITION ($r=.83$, $p<.05$): measured by the distance in inches from each boy's bed to the author's bed with the closest being the number one position.

(2) HIKING POSITION ($r=.83$, $p<.05$): based on the average position of the boys as the group hiked single-file on eight occasions.

A non-significant but high correlation was computed between the dominance hierarchy and the following rank-orderings:

(3) ATHLETIC ABILITY (r=.71, n.s.): assessed verbally by asking the group members who were the best athletes in the cabin and then averaging the individual rankings, and behaviorally by compiling a conglomerate ordering based on athletic achievement during camp (the two rankings were identical).

(4) PHYSICAL FITNESS (r=.66, n.s.): assessed by the Harvard Step Test which considers the speed by which pulse rate recovers to its normal level following exercises.

(5) CHRONOLOGICAL AGE (r=.60, n.s.): information from birth dates as reported by parents on camper application forms.

(6) LATE POPULARITY (r=.60, n.s.): assessed by averaging the rankings of the boys on the "friend" sociometric exercise on Day Thirty-One and then compiling a group rank-order.

There was no relationship between the dominance hierarchy and the following rank-orderings:

(7) EARLY POPULARITY (r=.26, n.s.): same as (6) above except on Day Three.

(8) INTELLIGENCE (r=.14, n.s.): estimated by using the general information, similarities, and digit span sub-tests of the WISC.

(9) PUBERTAL STATUS (r=.09, n.s.): assessed by the author employing Tanner's States of Pubertal Development for Boys (Tanner, 1962). Each boy was given a stage number based on genital and pubic hair development.

(10) INTERNAL LOCUS OF CONTROL (r=.09, n.s.): scored from the Rotter's Internal-External Locus of Control Scale: the degree to which one believes that he, versus the rest of the world, controlsevents.

(11) BODY SURFACE AREA (r=-.31, n.s.): determined by utilizing the Dubois Body Surface Chart (Gallagher and Brouha, 1943). Surface area is derived by multiplying weight x height x a constant.

(12) CREATIVITY (r=-.37, n.s.): measured by the Torrance Test of Creativity, "Thinking Creatively with Words" (Torrance, 1966). Important are the elements fluency, flexibility, originality, and elaboration in the usage of words and ideas.

Characteristics of the Dominance Hierarchy

The observational record of dominance behavior reveals the following order and frequency of status indices utilized by the six boys during the 33 days of camp:

Verbal Ridicule----------235
Verbal Command/Order----------190
Ignoring or Refusal to Comply----------158
Physical Assertiveness with Contact---------- 93
Submits Self---------- 75
Verbal Battles---------- 74
Verbal or Physical Threat---------- 30
Physical or Object Displacement---------- 27

Individual patterns of dominance indices varied. For example, Alpha ranked high on all categories of dominance except physical threat while Omega was nearly last on all indices; Gamma had the most interesting pattern, ranking high on physical contact and physical threat but quite low on most verbal indices. Alpha and Beta were the most involved in status interactions (combined, 44% of the total). Except for Alpha's relations with the group, there was no systematic pattern suggesting that an individual was most apt to interact in a dominant-subordinant fashion with those closest to him in the hierarchy.

The sociometric rankings indicate: (1) Alpha and Beta under-estimated their hierarchical position by two or three places while the other group members over-ranked themselves by one position. (2) Best friends were close in rank except for the last two who chose Alpha as their best friend. (3) Socioempathy of the dominance hierarchy was not related to status rank, i.e., both high and low ranking members were equally aware of the dominance hierarchy.

Individual Differences: Alpha vs. Omega

Alpha was equally dominant in all five settings while Omega was most successful during group discussions and rarely dominant during meals and athletic activities (70% vs. 8%). While Alpha was never subordinate in a threat situation, Omega was never dominant in a verbal or physical threat interaction.

Both Alpha and Omega were well liked by the group--but perhaps for quite different reasons: Alpha for his status and Omega because he was rarely antagonistic toward others. The two differed most in their physical abilities: Alpha ranked first in hiking, athletic ability, and physical fitness while Omega was either last or next to last in those areas. Alpha was also a leader outside the camp

setting, in his school's student council and athletic games; Omega listed no leadership positions on his campers' application form.

On the group characterization exercise at least three of the cabin members nominated Alpha as the most athletic, irreligious, dominant, popular, and stubborn and as the best "little chief" (a position of leadership in the camp). Omega, by contrast, was characterized as the most mature, friendly, religious, quiet, and serious and as the cabin "brown-noser."

Overall, Alpha appeared to be the all-American boy: athletic, witty, popular, intelligent, handsome, and possessing an aura that bred confidence and authority. On the other hand, Omega was an individual who blended into the surroundings. Many times during camp he would be missing and no one would notice.

DISCUSSION

Based on the present results it does not appear unreasonable to conclude that man shares with other primate species a means of structuring social relations that can best be characterized as a dominance hierarchy. This is not to imply that the group structure is invariant--but ordered nevertheless.

The definition of status or dominance employed in this study incorporated some of the same definitions utilized by primatologists: winning and losing fights, supplanting others, displaying threat gestures, and receiving the attention of others. The primary human addition was the wide usage of verbalizations to connote status.

Perhaps most surprising in these initial human studies is the rapidity with which a stable, ordered dominance hierarchy is formed. It is quite possible that "end anchoring," the tendency of individuals to identify the extreme stimuli in a series presented to him and to judge others relative to them (Sherif and Sherif, 1964), took place within hours of meeting. Disagreements and shifts may have occurred during the first few days, but by the end of camp everyone knew his place.

Unfortunately, encounters other than agonistic were not recorded; thus, it is difficult to place dominance into the broader perspective of other social interactions, e.g., friendliness, cooperation, neutrality, etc. Yet, despite the low incidence of dominance interactions--7.6 per hour--when total interactions are considered, it is significant that such a low occurring behavior appears to be an influential factor in structuring important social and interpersonal interactions.

Perhaps one reason that the lower half of the behavioral dominance hierarchy appears unstable is that Delta and Epsilon interchanged positions after two weeks of camp. On Day Eleven the cabin group went hiking and Alpha and Beta, as was usual, ran ahead of the group. Epsilon (then Delta) attempted to tag along, much to the consternation of the other two. Angrily, Alpha nicknamed Epsilon the "shadow." During lunch the next day, Alpha decided to give Epsilon a hard time clearing and cleaning the table, demanding seconds and "accidentally" squirting ketchup on the table. Beta and others readily joined in the fun. While Epsilon enjoyed the attention, he was not so fond of the verbal and physical ridicule that would be his fate for the next week and a half. Despite the fact that overall status interactions were declining (see Figure One), Epsilon received an inordinate barrage of agonistic behavior. Alpha and Beta quadrupled the number of times they dominated him during the second nine days in comparison to the first nine days of camp. Not to be outdone, the two boys below Epsilon in the hierarchy quintupled their domination over Epsilon during the same period. The net effect was to lower Epsilon and raise Delta one notch.

The important facet of the above illustration, however, is the demonstration of Alpha's power and influence on the behavior of other group members. In other areas of group life Alpha's presence was felt: he organized and directed the athletic games, telling who to play where and for how long; though he did not suggest many activities or ideas, they were acknowledged and passed when he did; and when he told a late-night joke, everyone laughed. But it is not to be assumed that other group members were not also vital to the proper functioning of the group. The role of lower-status group members appeared to be that of worker, to do the tasks decided upon by higher-status members. When the author, playing the role of cabin counselor, attempted to provide the lower-ranking group members status roles or jobs, they usually backed down, emitting a high anxiety level. Whether to force or to let alone presents a dilemma to many parents, teachers, and cabin counselors.

Finally, one can examine the adaptive functions of the formation and maintenance of a dominance hierarchy in adolescent groups. Chance (1967) and Eibl-Eibesfeldt (1970) ascribe to the dominance hierarchy in human groups the function of adding stability and expectancy to social living and thus contributing to a cohesive group. During the course of the five-week camping period the number of dominance interactions fell precipitously (see Figure One). The number of dominance interactions during the first 15 days (579) is significantly greater than during the last 15 days (240) ($t_{(28)}=3.10$, $p<.005$). The first week of camp was

characterized by much contesting and assertion of status; thereafter appeared an acceptance of one's hierarchical position. The upward increment in dominance interactions during the last week of camp may be due to either a general end-of-camp excitement or to a last-minute reinforcement and assertion of status. Stabilizing the group dominance hierarchy appears to have contributed to the reduction of agonistic behavior. If so, then status differentiation may well serve the adaptive function of contributing toward peaceful group living.

On an individual level, the dominance hierarchy may serve as an indicator of one's roles, obligations, and functions in the group. While ranking high did contribute toward achieving priority to resources and perhaps competition between males, being dominant may be its own reward (Washburn and Hamburg, 1968). This rewarding attribute of high status may explain in part the most interesting finding of the previous study (Williams, 1974) as well as the present one: the high correlation between the dominance hierarchy and bed position. For the early adolescent, to sleep next to the adult counselor may be an indication of status: to associate and perhaps identify with the ultimate source of power in the cabin group.

"Shut up," said Ralph absently. He lifted the conch. "Seems to me we ought to have a chief to decide things."

"A chief A chief "

"I ought to be chief," said Jack with simple arrogance, "because I'm chapter chorister and head boy. I can sing C sharp."

Another buzz. . .

This toy of voting was almost as pleasing as the conch. Jack started to protest but the clamor changed from the general wish for a chief to an election by acclaim of Ralph himself. None of the boys could have found good reason for this; what intelligence had been shown was traceable to Piggy while the most obvious leader was Jack. But there was a stillness about Ralph as he sat that marked him out: there was his size, and attractive appearance; and most obscurely, yet most powerfully, there was the conch. . .

Ralph raised a hand for silence.

"All right. Who wants Jack for chief?"

With dreary obedience the choir raised their hands.

"Who wants me?"

Every hand outside the choir except Piggy's was raised immediately. Then Piggy, too, raised his hand grudgingly into the air.

Ralph counted.

"I'm chief then."

(William Golding, Lord of the Flies, p. 19).

TABLE 1.: FREQUENCY OF BEHAVIORAL INTERACTIONS (N=662) X DOMINATES Y (TOTAL 33 DAYS)

dominates (X) \ dominated (Y)	1	2	3	4	5	6	total
1		110 *68%**	73 95%	40 88%	58 97%	38 95%	320 83%
2	51 32%		51 91%	32 80%	04 04%	28 97%	256 66%
3	4 5%	5 9%		38 95%	35 76%	20 91%	102 42%
4	7 13%	0 20%	2 5%		40 48%	10 46%	76 20%
5	2 3%	4 4%	11 24%	44 52%		18 60%	81 25%
6	2 5%	1 3%	2 0%	22 54%	12 40%		30 24%

*first column is raw number of times X dominates Y
**second column is percent of times X dominates Y

TABLE 2.: BINOMIAL PROBABILITY DISTRIBUTION: X DOMINATES Y*

dominates (X) \ dominated (Y)	1	2	3	4	5	6
1		.0000	.0000	.0000	.0000	.0000
2			.0000	.0000	.0000	.0000
3				.0000	.0003	.0001
4						
5				.3718		.1808
6				.3776		

*P(n,r,p), the probability that at least r successes will occur in n independent trials where p=.50. Interactions from the complete observational record.

TABLE 3.: SOCIOMETRIC RANK-ORDERING OF DOMINANCE: DAY THREE AND DAY THIRTY-ONE

ranker	1		2		3		4		5		6	
1	1*	**	2	1	3	2	5	3	4	5	-	
2	2	1	5	4	1	3	4	2	3	6	-	
3	1	1	3	3	2	2	5	4	4		-	
4	1	2	2	1	3	5	5	4	4	3	-	
5	1	1	2	2	4	5	5	4	3	3	-	
6	-	2	-	1	-	5	-	3	-	6	-	
ave.	1.2	1.8	2.8	2.0	2.6	3.8	4.8	3.3	3.6	4.7	-	5.3

*first column is Day 3, intra-group ranking, xr^2=14.1, p≤.01
**second column is Day 31, intra-group ranking, xr^2=17.0, p≤.01 (Friedman Two-Way Analysis of Variance by Rank, Siegel, 1956)
***no ranking available because of Omega's absence from camp

TABLE 4.: FREQUENCY OF BEHAVIORAL INTERACTIONS (N=74) X DOMINATES Y (FIRST THREE DAYS)

dominates (X)	dominated (Y) 1		2		3		4		5		total	
1			18*	64%**	6	75%	8	100%	1	100%	33	73%
2	10	36%			11	92%	2	50%	6	75%	29	56%
3	2	25%	1	9%			4	100%	-	***	7	29%
4	0	0%	2	50%	0	0%			1	100%	3	18%
5	0	0%	2	25%	-	***	0	0%			2	20%

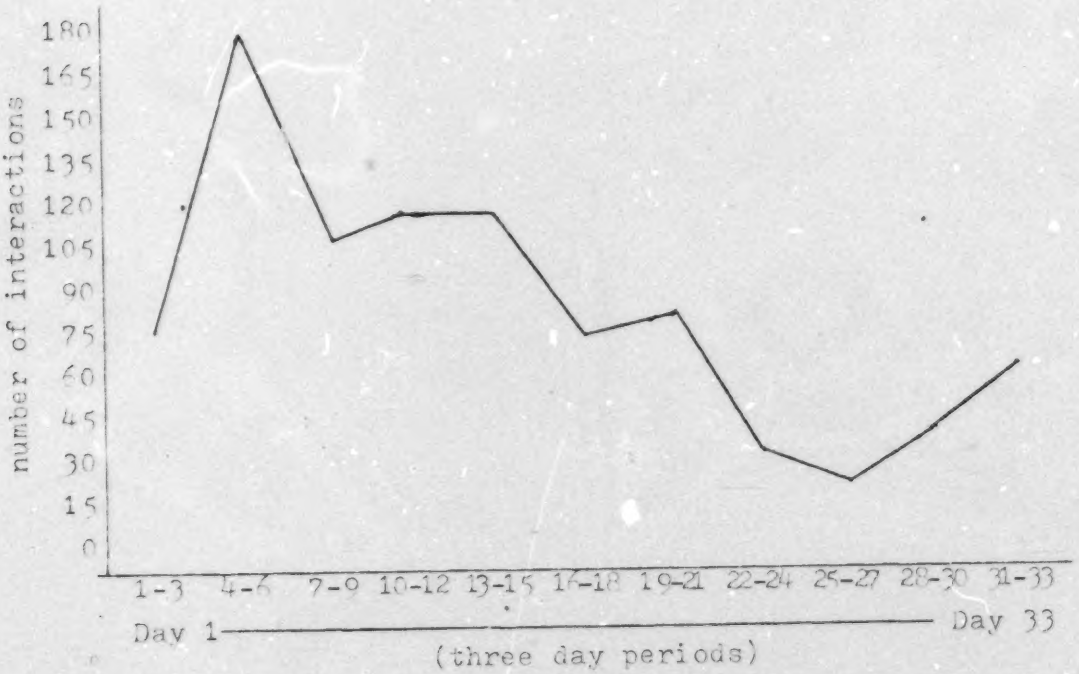
*first column is raw number of times X dominates Y
**second column is percent of times X dominates Y
***no interactions

TABLE 5.: FREQUENCY OF BEHAVIORAL INTERACTIONS (N=100) X DOMINATES Y (LAST SIX DAYS)

dominates (X)	dominated 1		2		3		4		5		6		total	
1			15*	94%**	9	100%	3	100%	1	100%	14	100%	42	98%
2	1	6%			2	100%	5	71%	3	100%	9	100%	20	54%
3	0	0%	0	0%			4	100%	2	100%	7	100%	13	54%
4	0	0%	2	29%	0	0%			9	75%	5	83%	16	50%
5	0	0%	0	0%	0	0%	3	25%			4	80%	7	30%
6	0	0%	0	0%	0	0%	1	17%	1	20%			2	5%

*first column is raw number of times X dominates Y
**second column is percent of times X dominates Y

FIGURE 1.: FREQUENCY OF DOMINANCE INTERACTION ACROSS TIME



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